THE NEXT GENERATION
Implementation of Precision Satellite Navigation

- **AREA NAVIGATION**
- **WIDE AREA AUGMENTATION SYSTEM**
- **LATERAL/VERTICAL NAVIGATION**

INTRODUCTION

The Washington State Department of Transportation Aviation Division, in partnership with the Federal Aviation Administration created this information package to help clarify the implementation process of the GPS precision instrument approach program, known as WAAS. WAAS stands for the Wide Area Augmentation System and the program will provide satellite-based navigation capability for all phases of flight from enroute through precision approach. We look forward with much anticipation to the opportunities of GPS technology and the programs it supports.

It is important to us that airport sponsors have a clear understanding about the implementation realities of the WAAS program: timing of satellite coverage, facility requirements and land use requirements. Airport sponsors have much work ahead to prepare airports for a WAAS Approach particularly for precision approach minimums of less than 3/4 mile. This information package will shed light on what to expect and more importantly, how and what to plan for the implementation of a GPS precision instrument approach.

THE FUTURE OF NAVIGATION

For several years now, the Global Positioning System (GPS) has been recognized as the future of navigation for many applications and various modes of transportation. Since the early 1990's, the Federal Aviation Administration committed itself to the development of a safe and efficient satellite based navigation system to meet the future needs of civil aviation. GPS is the technological mechanism to enable that reality. Consider GPS as the technology umbrella which drives the new navigation programs WAAS and LAAS (Local Area Augmentation System.) The FAA's primary mission for the WAAS program is to provide satellite-based navigation capability for all phases of flight. The satellite-based technology will provide a three-dimensional primary means of navigation for civil and military aircraft equipped with a certified GPS/WAAS receiver.

The benefits from WAAS and the increased accuracy and integrity will be significant. Aircraft will be able to fly more direct routes to their destinations - saving time, fuel and money. It will enable the possibility of precision approaches at airports never previously served by precision technology and without ground-based navigation equipment like a VOR or NDB Approach. The WAAS system will provide service comparable to current instrument landing systems at 2,600 IFR airports and will offer the potential for new precision approach services at many of the 11,000 VFR airports.

EVERYTHING OLD IS NEW AGAIN

Just when you adjusted your vocabulary to add GPS – along comes a new set of acronyms to describe precision and non-precision GPS approaches. Area Navigation known as RNAV now defines those systems like GPS which navigate with reference to geographic positions called waypoints (WP) based on latitude and longitude rather than to/from a specific ground based navigation aid. The Federal Aviation Administration is developing a new charting format for RNAV instrument approach procedures. In order to avoid a proliferation of instrument approach charts, the new approach charts will contain as many as four lines of approach minimums to incorporate the new types of approaches.

The four new approach options are as follows: WAAS (Wide Area Augmentation System), LNAV/VNAV (Lateral Navigation/Vertical Navigation), LNAV, and Circling.

<u>WAAS Approach</u>

The WAAS A pproach will accommodate a precision GPS approach --new title, same idea. In technical terms, the WAAS augments the basic GPS satellite constellation with additional ground stations and enhanced position information transmitted from geostationary satellites. With the capability of increased accuracy and integrity, the WAAS Approach may support approach minimums as low as 200' Height Above Touchdown (HAT) and 1/2 statute mile visibility. In order to achieve the lowest minimums, your airport must meet the requirements of an entire precision system including:

1. Satellite Availability - Washington State will not receive satellite coverage until the satellite is launched and the ground station is in place. Availability of satellite coverage for Washington may range from 2002 to 2005. The enclosed map illustrates satellite coverage for Phase 1.
2. Clear Obstruction Surfaces - Clear approach surfaces are a critical component to implementation of satellite navigation at your airport. Sponsors must actively seek land use regulations to preserve clear approach surfaces.
3. Requirements of DRAFT FAA Advisory Circular 150/5300-13, Airport Design (Change 6.)
4. Precision runway and airport requirements, including lighting requirements.

LNAV/VNAV Approach

A number of airports will not meet the requirements for a WAAS precision approach or may face conditions of poor GPS satellite coverage including atmospheric interference. In this case, an airport may revert to a less capable mode of operation called an LNAV/VNAV (Lateral Navigation/Vertical Navigation) Approach. For this operation, lateral and vertical navigation are still available but to a somewhat lesser degree of accuracy and integrity. There are two circumstances that an LNAV/VNAV Approach may be in effect: 1) the WAAS satellite signal is not as accurate as required or atmospheric conditions like sun spots reduce the quality of the signal. A WAAS receiver will detect the condition and pilots will use alternative LNAV/VNAV minima. Since vertical guidance is provided, the minima will be published as a Descent Altitude. 2) Due to location, the airport will not receive the level of accuracy with the satellite signal to achieve the requirements of a WAAS Approach. Similar to the first circumstance, pilots/crew members will utilize LNAV/VNAV minima for the approach. The LNAV/VNAV Approach is still a precision approach but with less precision than available through a WAAS Approach.

LNAV Approach

The LNAV Approach is a lateral approach without the vertical approach component. In other words, the LNAV Approach is a non-precision GPS approach. The minima for an LNAV-only Approach will be published as a Minimum Descent Altitude (MDA) because vertical guidance is not provided. This minima provides adequate but less precise navigation when the quality of the WAAS signal will not support vertical navigation of if airport conditions do not meet the requirements for an LNAV/VNAV Approach.

ASSESSING YOUR AIRPORT FOR WAAS IMPLEMENTATION

Airport sponsors are a primary component in the successful implementation of WAAS throughout the National Airspace System. Much preparation is needed at your airport to meet the design standard requirements to facilitate a precision satellite approach at your facility. Whether satellite coverage and ground based facilities are available tomorrow or in ten years, airport sponsors should begin preparations for this technology now.

We prepared a worksheet for you to assess the facility needs for a WAAS, LNAV/VNAV and LNAV approach at your airport. It is our hope the attached worksheet will help you identify the facility improvements with the preferred approach and begin estimating the potential costs associated in preparing for the new approach. Since a majority of airports in our state have Airport Reference Codes (ARCs) of A, B-I or B-II, we provided the design standards which correspond to those ARCs for the three new approach alternatives. If you are an airport with an ARC greater than B-II, please contact us and we will develop a worksheet for your specific ARC.

The worksheet provides an area for you to list the existing conditions at your airport, including aircraft approach category, airplane design group, runway length, width and marking, runway safety area, runway protection zone, obstacle free zone, runway object free area, precision object free area, runway edge lights, runway centerline, taxiway information, approach lights, threshold siting, approach surface and current survey.

Following input of your existing conditions, the worksheet asks you to choose which approach you want to plan for – WAAS: Precision with Approach Minimums of less than 3/4 mile visibility, LNAV/VNAV: Non-Precision with Vertical Guidance and Approach Minimums of less than 3/4 mile visibility, LNAV: Non-Precision with Approach Minimums of greater than 1 mile visibility. Although the lowest minimums may not be available for 2-5 years, the decision on ultimate desired minimums should be made as early as possible.

Next step on the worksheet is to determine what improvements are needed at your airport to facilitate the new approach considering a 5-Year forecast. The final – and probably most important step is to calculate how much it will cost you to upgrade your facility to meet the requirements for a precision satellite approach.

ON YOUR MARK

With the introduction of DRAFT Change 6 to the FAA Advisory Circular 150/5300-13, Airport Design, the FAA amended the airport design standard criteria to include provisions for a WAAS Approach. We will provide additional information to you in the event of future modifications to design standards. However, one factor remains constant. The WAAS Approach is dependent on an approach clear of obstructions. Efforts by airport sponsors to work with local jurisdictions to preserve unobstructed approaches through land use development regulations are paramount to the successful implementation of precision satellite approach technology.

The Washington State DOT Aviation Division is available to assist in your coordination efforts with your local jurisdiction as a part of the state's Airport Land Use Compatibility Program. Examples of development regulations currently in place throughout Washington state are available through the state's web site www.wsdot.wa.gov/aviation/planning or available by contacting (206) 764-4131 or (800) 552-0666.